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EXAMINER

GREENE, JASON M

ART UNIT	PAPER NUMBER
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1724

DATE MAILED: 09/24/2002

Please find below and/or attached an Office communication concerning this application or proceeding.



mk-10

<b>Office Action Summary</b>	<b>Application No.</b> 09/871,582	<b>Applicant(s)</b> BARRIS ET AL.	
	<b>Examiner</b> Jason M. Greene	<b>Art Unit</b> 1724	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☐ Claim(s) \_\_\_\_ is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-149 is/are rejected.
- 7) ☒ Claim(s) 57, 85 and 139 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 31 May 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
     Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.  
     If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
     a) ☐ All    b) ☐ Some \*    c) ☐ None of:  
         1. ☐ Certified copies of the priority documents have been received.  
         2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.  
         3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
     \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).  
     a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s) ____    |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) <u>6, 7, 8, 9</u> | 6) <input type="checkbox"/> Other: _____                                    |



## **DETAILED ACTION**

### ***Specification***

1. The disclosure is objected to because pages 68-70 of the Specification have been written on in landscape orientation rather than in portrait orientation. See 37 CFR 1.52(a)(iii). Appropriate correction is required.

### ***Claim Objections***

2. Claims 57 and 85 are objected to because of the following informalities: The word "polymer" should be inserted between the words "condensation" and "comprises" in line 1. Appropriate correction is required.
3. Claim 139 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claim 139 is dependent upon claim 1324. However, only claims 1-149 are pending. It appears as though claim 139 should depend from claim 132. For examination purposes, claim 139 has been assumed to be dependent upon claim 132.



***Claim Rejections - 35 USC § 112***

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 1, 6, 9, 21, 23, 76, 105, 128, 132, and 146 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claims 1, 128, 132, and 146, the phrase "sheet-like" renders the claim(s) indefinite because the claim(s) include(s) elements not actually disclosed (those encompassed by "sheet-like"), thereby rendering the scope of the claim(s) unascertainable. See MPEP § 2173.05(d).

Claim 6 recites the limitation "the polyvinylidene halide" in line 1. There is insufficient antecedent basis for this limitation in the claim. It appears as though claim 6 should be dependent upon claim 5. For examination purposes, claim 6 was assumed to depend from claim 5.

Claim 9 recites the limitation "the polyvinylalcohol" in line 1. There is insufficient antecedent basis for this limitation in the claim. It appears as though claim 9 should be



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dependent upon claim 8. For examination purposes, claim 9 was assumed to depend from claim 8.

Claim 21 recites the limitation "the nylon copolymer" in line 1. There is insufficient antecedent basis for this limitation in the claim.

Claim 23 recites the limitation "the second nylon polymer" in line 1. There is insufficient antecedent basis for this limitation in the claim. It appears as though claim 23 should be dependent upon claim 21. For examination purposes, claim 23 was assumed to depend from claim 21.

Claims 76 and 105 recite the limitation "said first and second end caps" in line 3. There is insufficient antecedent basis for this limitation in the claims.

***Claim Rejections - 35 USC § 103***

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.



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7. Claims 1-7 and 48-52 are rejected under 35 U.S.C. 103(a) as being unpatentable over Engel '992 in view of Kahlbaugh et al. '399.

With regard to claim 1, Engel '992 discloses a filter element (21) comprising a media pack (25) comprising a construction of a media composite, said construction including a sheet-like substrate (30) having a plurality of pleats having a length extending from said first end to said second end, said construction having a tubular shape and defining an open interior having a first and a second opposite ends, a first end cap (23) and a second end cap (24), said media pack being secured to said first end cap at said first end of said media pack, said media pack being secured to said second end cap at said second end of said media pack, at least one of said first and second end caps including a radially directed sealing portion (40), said radially directed sealing portion comprising a polyurethane material compressible in a direction toward said media pack in Figs. 1-4 and col. 3, line 7 to col. 5, line 60.

Engel '992 does not disclose said sheet-like substrate at least partially covered by a layer, said layer comprising a polymeric fine fiber comprising a fiber with a diameter of about 0.01 to 0.5 microns such that after test exposure for a test period of 16 hours to test conditions of 140 °F air and a relative humidity of 100% retains greater than 30% of the fiber unchanged for filtration purposes

Kahlbaugh et al. '399 discloses a similar filter assembly having a filter media comprising a pleated filter media composite including a sheet-like substrate (31) at least partially covered by a layer of fine fiber (32), said fiber comprising a diameter of



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0.1 microns in Figs. 8-11, col. 14, line 35 to col. 17, line 28, and col. 25, line 5 to col. 27, line 32.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the filter media of Kahlbaugh et al. '399 into the air filter assembly of Engel '992 to provide an improved filter media having a longer lifetime at a given efficiency and flow rate, as suggested by Kahlbaugh et al. '399 in col. 1, line 3 to col. 3, line 35 and col. 9, line 15 to col. 11, line 28.

Since the prior art is seen as disclosing a specific example lying within the claimed range of the fine fiber comprising a diameter of about 0.01 to 0.5 microns, this limitation is anticipated.

With regard to the thermal and humidity resistance of the fine fibers, both Applicants and Kahlbaugh et al '399 disclose forming the fine fiber layer of the same materials. Specifically, Applicants teach forming the fine fiber layer from polyolefin, polyvinyl chloride (PVC), cellulose ester, polyamides, polystyrene, polysulfones, polyvinylidene fluoride, polyvinylidene chloride, and nylon in page 13, lines 3-30. Kahlbaugh et al. '399 teaches forming the fine fibers from identical materials in col. 16, lines 53-64. Since Applicants and Kahlbaugh et al '399 both teach the fine fiber layer being formed from the same material, the fine fibers of Kahlbaugh et al. '399 would inherently have the same heat and humidity resistance properties as the fine fibers of the present invention.



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With regard to claim 2, Kahlbaugh et al. '399 discloses the fine fiber comprising the condensation polymers nylon and cellulose ether in col. 16, lines 53-64.

With regard to claims 3-7, Kahlbaugh et al. discloses the fine fiber comprising the addition polymers polyvinyl chloride, polyvinylidene fluoride, and polyvinylidene chloride in col. 16, lines 53-64.

With regard to claim 48, Engel '992 discloses the sealing portion comprising polyurethane foam having an as molded density of 14-22 lbs/in<sup>3</sup> in col. 3, lines 7-13.

With regard to claim 49, Engel '992 discloses the first end cap (23) being ring shaped and defining an open center and includes an inner radial seal surface (40) facing the open center, the sealing portion comprising said inner radial surface in Fig. 4 and col. 5, lines 30-60.

With regard to claim 50, Engel '992 discloses the filter element further including an inner support liner (26) extending between the first and second end caps, said inner support liner being between said sealing portion and said media pack in Fig. 4 and col. 5, lines 19-23.



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With regard to claims 51, Engel '992 discloses the second end cap (24) including an outer radial surface (75), said sealing portion comprising said outer radial surface in Fig. 5 and col. 6, line 60 to col. 7, line 15.

With regard to claim 52, Engel '992 discloses the filter element further including an inner support liner (26) extending between the first and second end caps and an outer support liner (27) extending between the first and second end caps in Fig. 4 and col. 5, lines 19-23.

Engel '992 does not disclose each of said plurality of pleats having a pleat length of at least 6 inches and a pleat depth of at least 1 inch.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to adjust the pleat length to be at least 6 inches and the pleat depth to be at least 1 inch to provide a filter element having a specific pleat arrangement for an intended application.

8. Claims 8 and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Engel '992 and Kahlbaugh et al. '399 as applied to claims 1 and 2 above, and further in view of Emig et al.

With regard to claim 8, Engel '992 and Kahlbaugh et al. '399 do not disclose the fine fiber comprising polyvinyl alcohol.



Emig et al. discloses a similar filter media having a layer of fine fiber supported on a substrate wherein the fine fiber comprises polyvinyl alcohol in col. 2, lines 26-53.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the polyvinyl alcohol or copolymer of vinyl alcohol fine fibers of Emig et al. into the filter media of Engel '992 and Kahlbaugh et al. '399 in that such is merely an alternate material in the art for forming a layer of fine fibers, mere substitution of one known fine fiber forming material for another in the art without a showing of unobvious or unexpected results being within the scope of one having ordinary skill in the art.

With regard to claim 37, Engel '992 and Kahlbaugh et al. '399 do not disclose the fine fiber comprising a blend of a polyurethane polymer and a polyamide polymer.

Emig et al. discloses a similar filter media having a layer of fine fiber supported on a substrate wherein the fine fiber comprises a blend of a polyurethane polymer and a polyamide polymer.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the blend of polyurethane and polyamide of Emig et al. for the polymers of Engel '992 and Kahlbaugh et al. '399 in that such are alternate polymers in the art for forming fine fibers, mere substitution of one known fine fiber forming polymer for another in the art being within the scope of one having ordinary skill in the art.



9. Claims 9-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Engel '992 and Kahlbaugh et al. '399 as applied to claim 1 above, and further in view of Emig et al. and European Patent Application EP 0 351 046

With regard to claims 9-11, Engel '992 and Kahlbaugh et al. '399 do not disclose the fine fiber comprising polyvinyl alcohol or the polyvinyl alcohol being crosslinked with about 1 to 40 weight percent of a cross linking agent.

Emig et al. discloses a similar filter media having a layer of fine fiber supported on a substrate wherein the fine fiber comprises polyvinyl alcohol in col. 2, lines 26-53.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the polyvinyl alcohol or copolymer of vinyl alcohol fine fibers of Emig et al. into the filter media of Engel '992 and Kahlbaugh et al. '399 in that such is merely an alternate material in the art for forming a layer of fine fibers, mere substitution of one known fine fiber forming material for another in the art without a showing of unobvious or unexpected results being within the scope of one having ordinary skill in the art.

Engel '992, Kahlbaugh et al. '399, and Emig et al. do not disclose the polyvinyl alcohol being crosslinked with about 1 to 40 weight percent of a crosslinking agent.

EP 0 351 046 discloses crosslinking polyvinyl alcohol with 20 weight percent of a polyacrylic acid in page 2, line 42 to page 3, line 7 and page 6, lines 26-51.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the crosslinking of EP 0 351 046 into the fine fiber of



Engel '992, Kahlbaugh et al. '399, and Emig et al. to provide a polyvinyl alcohol fine fiber having improved hot water resistance, as suggested by EP 0 351 046 in page 2, line 10 to page 3, line 5.

With regard to claim 12, EP 0 351 046 teaches using polyacrylic acid having any desired molecular weight in page 2, line 54.

Since the prior art range is seen as overlapping the claimed range of a molecular weight between about 1000 and 3000, a prima facie case of obviousness exists which must be overcome through a showing of unexpected or unobvious results.

Furthermore, EP 0 351 046 explicitly teaches the polyacrylic acid having a degree of polymerization of 200 in page 2, lines 54-55. Since acrylic acid has the formula  $\text{CH}_2\text{CHCOOH}$ , the molecular weight of the acrylic acid monomer can be calculated to be 72 and the molecular weight of a polyacrylic acid having a degree of polymerization of 200 can be calculated to be  $72 \times 200 = 14,400$ . It would have been obvious to one of ordinary skill in the art at the time the invention was made to use a polyacrylic acid having a molecular weight of about 3000 since a polyacrylic acid having a molecular weight of about 3000 would be expected to exhibit properties similar to a polyacrylic acid having a molecular weight of 14,400.

10. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Engel '992, Kahlbaugh et al. '399, Emig et al., and European Patent Application EP 0 351 046 as applied to claim 10 above, and further in view of Elmasry.



EP 0 351 046 discloses crosslinking polyvinyl alcohol with 20 weight percent of a crosslinking agent in page 2, line 42 to page 3, line 7 and page 6, lines 26-51.

Engel '992, Kahlbaugh et al. '399, Emig et al., and EP 0 351 046 do not disclose the polyvinylalcohol being crosslinked using a melamine-formaldehyde resin having a molecular weight of about 1000 to 3000.

Elmasry teaches using melamine-formaldehyde to crosslink polyvinylalcohol in col. 1, lines 36-39.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the melamine-formaldehyde crosslinking agent of Elmasry into the polyvinylalcohol of Engel '992, Kahlbaugh et al. '399, Emig et al., and EP 0 351 046 in that such is an alternate crosslinking agent in the art for crosslinking polyvinylalcohol, mere substitution of one known crosslinking agent for another in the art without a showing of unobvious or unexpected results being within the scope of one having ordinary skill in the art.

EP 0 351 046 teaches the crosslinking agent having any desired molecular weight in page 2, line 54.

Since the prior art range is seen as overlapping the claimed range of a molecular weight between about 1000 and 3000, a prima facie case of obviousness exists which must be overcome through a showing of unexpected or unobvious results.



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11. Claims 14-16, 27-32, and 41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Engel '992 and Kahlbaugh et al. '399 as applied to claim 2 above, and further in view of Gallucci '474.

With regard to claims 14-16 and 41, Kahlbaugh et al. '399 discloses the polymer comprising nylons, aromatic nylons, or copolymers of nylons and aromatic nylons in col. 18, lines 48-64. Since Kahlbaugh et al. '399 teaches using nylons, aromatic nylons, or copolymers of nylons and aromatic nylons, Kahlbaugh et al. '399 is seen as teaching the polymer comprising a condensation polymer other than a copolymer formed from a cyclic lactam and a C<sub>6-10</sub> diamine monomer or a C<sub>6-10</sub> diacid monomer.

Engel '992 and Kahlbaugh et al. '399 do not disclose the condensation polymer including a resinous additive comprising an oligomer having a molecular weight of about 500 to 3000 and an alkyl phenolic character wherein the additive is miscible in the condensation polymer.

Gallucci '474 discloses forming fibers from a polymer comprising nylon and a resinous additive comprising a oligomer having a molecular weight of about 400 to 30000 and an alkyl phenolic character wherein the additive is miscible in the condensation polymer in col. 1, line 18 to col. 5, line 19.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the incorporate the additive of Gallucci '474 into the nylon fibers of Engel '992 and Kahlbaugh et al. '399 to improve the dimensionally



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stability of the fibers and to reduce the water absorption by the fibers, as suggested by Gallucci '474 in col. 1, line 29 to col. 2, line 41.

Since the prior art range is seen as overlapping the claimed range of the molecular weight being about 500 to 3000, a prima facie case of obviousness exists which must be overcome through a showing of unobvious or unexpected results.

With regard to claims 27 and 28, Gallucci '474 teaches the additive comprising an oligomer comprising tertiary butyl phenol and having the claimed structure in col. 1, line 49 to col. 5, line 10. Gallucci '474 is seen as disclosing the claimed structure when R is a tertiary butyl group, R' is a direct carbon to carbon bond, and s equals 1.

With regard to claims 29 and 30, Gallucci '474 teaches the additive comprising an oligomer comprising bis-phenol A and having the claimed structure in col. 1, line 49 to col. 5, line 10 and col. 7, lines 28-35. Gallucci '474 is seen as disclosing the claimed structure when R is a alkyl hydroxy aryl group, R' is a direct carbon to carbon bond, and s equals 1.

With regard to claims 31 and 32, Gallucci '474 teaches the additive comprising an oligomer comprising dihydroxy biphenyl and having the claimed structure in col. 1, line 49 to col. 5, line 10. Gallucci '474 is seen as disclosing the claimed structure when R is a hydroxy aryl group, R' is a direct carbon to carbon bond, and s equals 1.



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12. Claims 17 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Engel '992 and Kahlbaugh et al. '399 as applied to claim 2 above, and further in view of Emig et al. and Baumann et al.

Engel '992 and Kahlbaugh et al. '399 do not disclose the polymer comprising a polyalkylene terephthalate.

Emig et al. teaches forming microfibers from copolymers of polyamides and polyesters in col. 2, lines 59-65.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the copolymer of polyamide and polyester of Emig et al. for the polymers of Engel '992 and Kahlbaugh et al. '399 in that such are alternate polymers in the art for forming fine fibers, mere substitution of one known fine fiber forming polymer for another in the art being within the scope of one having ordinary skill in the art.

Engel '992 Kahlbaugh et al. '399, and Emig et al. do not disclose the polyester being a polyalkylene terephthalate.

Baumann et al. teaches polyethylene terephthalate being a well known polyester used in the formation of fine fibers in col. 5, lines 45-67.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the polyethylene terephthalate of Baumann et al. for the polyesters of Engel '992, Kahlbaugh et al. '399, and Emig et al. in that such are alternate polyesters in the art for forming fine fibers, mere substitution of one known fine



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fiber forming polyester for another in the art being within the scope of one having ordinary skill in the art.

13. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Engel '992, Kahlbaugh et al. '399, Emig et al. and Baumann et al., as applied to claim 17 above, and further in view of Asano et al.

Engel '992, Kahlbaugh et al. '399, Emig et al. and Baumann et al. do not disclose the polymer comprising polyalkylene naphthalate.

Asano et al. teaches it being well known to form fibers from polyalkylene naphthalate in col. 1, lines 42-45.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the polyalkylene naphthalate of Asano et al. into the fibers of Engel '992, Kahlbaugh et al. '399, Emig et al. and Baumann et al. to improve the durability of the fiber, as suggested by Asano et al. in col. 1, lines 42-45.

14. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Engel '992 and Kahlbaugh et al. '399 as applied to claim 2 above, and further in view of Baumann et al.

Kahlbaugh et al. '399 discloses the polymer being nylon in col. 16, lines 48-64.

Engel '992, Kahlbaugh et al. '399, and Gallucci '474 do not explicitly disclose the nylon polymer comprising a homopolymer having repeating units derived from a cyclic lactam.



Baumann et al. teaches forming fine fibers from a nylon polymer, wherein the polymer comprising a homopolymer (nylon 6) having repeating units derived from a cyclic lactam in col. 5, lines 45-67.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the nylon 6 of Baumann et al. for the nylons of Engel '992 and Kahlbaugh et al. '399 in that such are alternate nylons in the art for forming fine fibers, mere substitution of one known fine fiber forming nylon for another in the art being within the scope of one having ordinary skill in the art.

15. Claims 21-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Engel '992, Kahlbaugh et al. '399, and Gallucci '474 as applied to claim 16 above, and further in view of Okamoto et al. '352.

With regard to claims 21-23, Kahlbaugh et al. '399 discloses the polymer being nylon, aromatic nylon, or a copolymer of nylon and aromatic nylon in col. 16, lines 48-64.

Engel '992, Kahlbaugh et al. '399, and Gallucci '474 do not explicitly disclose the nylon polymer being a copolymer combined with a second nylon polymer, the second nylon polymer differing in molecular weight or monomer composition, the second nylon polymer comprising an alkoxy alkyl modified polyamide, or the second nylon polymer comprising a nylon copolymer.



Okamoto et al. '352 discloses forming fibers from copolymers of nylon 6, nylon 7, nylon 8, nylon 9, nylon 11, and nylon 12 in col. 3, lines 58-67. Therefore, Okamoto et al. is seen as teaching forming fibers from a copolymer of nylon 6 and nylon 7, wherein the copolymer is combined with a second nylon copolymer comprising an alkoxy alkyl modified polyamide (nylon 8) and nylon 9.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the nylon copolymers of Okamoto et al. '352 for the nylons of Engel '992, Kahlbaugh et al. '399, and Gallucci '474 in that such are alternate nylons in the art for forming fibers, mere substitution of one known fiber forming nylon for another in the art being within the scope of one having ordinary skill in the art.

With regard to claim 24, Okamoto et al. '352 teaches the nylons being combined to form a copolymer in col. 3, lines 58-67.

Engel '992, Kahlbaugh et al. '399, and Okamoto et al. '352 do not explicitly disclose the polymers being treated to from a single polymeric composition as measured by a differential scanning calorimeter showing a single phase material.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to ensure that the different polymers were sufficiently well mixed to form a single phase continuous copolymer material to ensure that the formed fibers exhibited the desired properties across the entire length and cross-section of the fibers.



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16. Claims 25 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Engel '992, Kahlbaugh et al. '399, and Okamoto et al. '352 as applied to claim 24 above, and further in view of Ueda et al. '055

With regard to claim 25, Engel '992, Kahlbaugh et al. '399, and Okamoto et al. '352 do not disclose the copolymer and the second polymer being heat treated.

Ueda et al. '055 discloses heat treating nylon fibers in col. 1, lines 23-26.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the heat treatment of Ueda et al. '055 into the fibers of Engel '992, Kahlbaugh et al. '399, and Okamoto et al. '352 to stabilize the fibers against heat and stress, as suggested by Ueda et al. in col. 1, lines 23-26.

With regard to claim 26, Ueda et al. discloses heat treating the nylon to a temperature ( $180^{\circ}\text{C}$ ) less than the lower melting point of the polymers in col. 2, lines 37-51.

17. Claims 33-35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Engel '992, Kahlbaugh et al. '399, and Gallucci '474 as applied to claim 14 above, and further in view of Jariwala et al.

Engel '992, Kahlbaugh et al. '399, and Gallucci '474 do not disclose the additive comprising a blend of the resinous additive and a fluoropolymer.



Jariwala et al. discloses adding a nonionic fluorocarbon surfactant to a polymeric fiber in col. 1, line 4 to col. 4, line 64 and col. 11, line 39 to col. 12, line 27.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the fluoropolymer of Jariwala et al. into the fiber of Engel '992 and Kahlbaugh et al. '399 to provide oil and water repellency to the fibers, as suggested by Jariwala et al. in col. 12, lines 7-27.

18. Claims 36-40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Engel '992, Kahlbaugh et al. '399, and Gallucci '474 as applied to claim 14 above, and further in view of Emig et al.

With regard to claims 36 and 38, Engel '992, Kahlbaugh et al. '399, and Gallucci '474 do not disclose the condensation polymer comprising a polyurethane polymer or a blend of a polyurethane polymer and a polyamide polymer.

Emig et al. teaches forming microfibers from polyurethane and a blend of polyurethane and polyamide in col. 2, lines 59-65.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the polyurethane and blend of polyurethane and polyamide of Emig et al. for the polymers of Engel '992, Kahlbaugh et al. '399, and Gallucci '474 in that such are alternate polymers in the art for forming fine fibers, mere substitution of one known fine fiber forming polymer for another in the art being within the scope of one having ordinary skill in the art.



With regard to claim 39, Kahlbaugh et al. '399 discloses the polyamide polymer comprising nylons, aromatic nylons, or copolymers of nylons and aromatic nylons in col. 18, lines 48-64.

With regard to claim 40, Kahlbaugh et al. '399 discloses the polyamide polymer comprising a nylon homopolymer or a copolymer of nylon and aromatic nylon in col. 16, lines 56-64.

19. Claim 42 is rejected under 35 U.S.C. 103(a) as being unpatentable over Engel '992, Kahlbaugh et al. '399, and Gallucci '474 as applied to claim 14 above, and further in view of Idemura et al.

Kahlbaugh et al. discloses the condensation polymer comprising an aromatic polyamide in col. 16, lines 56-64.

Engel '992, Kahlbaugh et al. '399, and Gallucci '474 do not disclose the condensation polymer being a reaction product of a diamine monomer and poly(m-phenylene isophthalamide).

Idemura et al. discloses forming fibers from an aromatic polyamide formed as a reaction product of a diamine monomer and poly(m-phenylene isophthalamide) in col. 7, lines 11-24.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the aromatic polyamide formed as a reaction product



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of a diamine monomer and poly(m-phenylene isophthalamide) of Idemura et al. into the fibers of Engel '992, Kahlbaugh et al. '399, and Gallucci '474 to produce fibers having a very high heat resistance, as suggested by Idemura et al. in col. 7, lines 11-24.

20. Claim 43 is rejected under 35 U.S.C. 103(a) as being unpatentable over Engel '992, Kahlbaugh et al. '399, Gallucci '474, and Emig et al. as applied to claim 38 above, and further in view of Muto et al.

Kahlbaugh et al. discloses the condensation polymer comprising an aromatic polyamide in col. 16, lines 56-64.

Engel '992 and Kahlbaugh et al. '399 do not disclose the condensation polymer being a reaction product of a diamine monomer and poly(p-phenylene terephthalamide).

Muto et al. discloses forming fibers from an aromatic polyamide formed as a reaction product of a diamine monomer and poly(p-phenylene terephthalamide) in col. 7, lines 11-24.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the aromatic polyamide formed as a reaction product of a diamine monomer and poly(m-phenylene isophthalamide) of Idemura et al. for the aromatic polyamides of Engel '992 and Kahlbaugh et al. '399 in that such are alternate aromatic polyamides in the art for forming fibers, mere substitution of one known fiber forming aromatic polyamide for another in the art without a showing of unobvious or unexpected results being within the scope of one having ordinary skill in the art.



21. Claim 44 is rejected under 35 U.S.C. 103(a) as being unpatentable over Engel '992, Kahlbaugh et al. '399, and Gallucci '474 as applied to claim 14 above, and further in view of Dzenis et al.

Engel '992 and Kahlbaugh et al. '399 do not disclose the condensation polymer comprising polybenzimidazole.

Dzenis et al. discloses forming fine fibers from polybenzimidazole in col. 12, lines 36-38.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the polybenzimidazole of Dzenis et al. for the condensation polymers of Engel '992 and Kahlbaugh et al. '399 in that such are alternate polymers in the art for forming fibers, mere substitution of one known fine fiber forming polymer for another in the art without a showing of unobvious or unexpected results being within the scope of one having ordinary skill in the art.

22. Claims 45 and 46 are rejected under 35 U.S.C. 103(a) as being unpatentable over Engel '992, Kahlbaugh et al. '399, and Gallucci '474 as applied to claim 14 above, and further in view of Ueda et al. '376.

With regard to claim 45, Engel '992 and Kahlbaugh et al. '399 do not disclose the condensation polymer comprising a polyarylate.

Ueda et al. '376 discloses forming fibers from polyarylate in col. 7, lines 52-65.



It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the polyarylate of Ueda et al. '376 for the condensation polymers of Engel '992 and Kahlbaugh et al. '399 in that such are alternate polymers in the art for forming fibers, mere substitution of one known fine fiber forming polymer for another in the art without a showing of unobvious or unexpected results being within the scope of one having ordinary skill in the art.

With regard to claim 46, Engel '992 and Kahlbaugh et al. '399 do not disclose the condensation polymer comprising a polyarylate and a polyamide.

Ueda et al. '376 discloses forming fibers from polyarylate in col. 7, lines 52-65.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the polyarylate of Ueda et al. '376 into the polyamide condensation polymers of Engel '992 and Kahlbaugh et al. '399 to reinforce the fine fiber layer, as suggested by Ueda et al. '376 in col. 7, lines 52-65.

23. Claim 47 is rejected under 35 U.S.C. 103(a) as being unpatentable over Engel '992, Kahlbaugh et al. '399, Gallucci '474, and Ueda et al. '376 as applied to claim 45 above and further in view of Okamoto et al. '707

Engel '992, Kahlbaugh et al. '399, and Ueda et al. '376 do not disclose the polyarylate polymer comprising a condensation polymerization reaction product between bis-phenol-A and mixed phthalic acids.



Okamoto et al. '707 discloses forming a polyarylate polymer as a reaction product between bis-phenol-A and mixed phthalic acids in col. 1, lines 34-38.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the polyarylate of Okamoto et al. '352 into the fiber of Engel '992, Kahlbaugh et al. '399, and Ueda et al. '376 to provide a fiber having excellent heat resistance, as suggested by Okamoto et al. in col. 1, lines 34-38.

24. Claims 53, 55, 62, 64-71, 81, 83, 90, 92-97, 99, and 100 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kahlbaugh et al. '399 in view of Gallucci '474.

With regard to claims 53 and 81, Kahlbaugh et al. '399 discloses a system including an engine or fluid compressor (part of the turbine) having an air cleaner constructed and arranged to filter the engine or compressor intake air, the air cleaner including a housing (101) and a primary filter element (103) positioned therein, the primary filter element comprising a media pack (110) having a first end and an opposite second end, said media pack including a pleated construction of a media composite, said pleated construction including a plurality of pleats having a length extending from said first end to said second end, said media composite including a substrate (150) at least partially covered by a layer (151), said layer comprising a fine fiber having a diameter of 0.1 microns such that after test exposure for a test period of 16 hours to test conditions of 140 °F air and a relative humidity of 100% retains greater than 30% of the fiber unchanged for filtration purposes, said fiber comprising polymeric



compositions including condensation polymers including nylon and addition polymers including polyvinyl chloride in Figs. 8-11, col. 2, lines 13-27, col. 14, line 35 to col. 17, line 28, and col. 25, line 5 to col. 27, line 32.

Since the prior art is seen as disclosing a specific example lying within the claimed range of the fine fiber comprising a diameter of about 0.01 to 0.5 microns, this limitation is anticipated.

With regard to the thermal and humidity resistance of the fine fibers, both Applicants and Kahlbaugh et al '399 disclose forming the fine fiber layer of the same materials. Specifically, Applicants teach forming the fine fiber layer from polyolefin, polyvinyl chloride (PVC), cellulose ester, polyamides, polystyrene, polysulfones, polyvinylidene fluoride, polyvinylidene chloride, and nylon in page 13, lines 3-30. Kahlbaugh et al. '399 teaches forming the fine fibers from identical materials in col. 16, lines 53-64. Since Applicants and Kahlbaugh et al '399 both teach the fine fiber layer being formed from the same material, the fine fibers of Kahlbaugh et al. '399 would inherently have the same heat and humidity resistance properties as the fine fibers of the present invention.

While Kahlbaugh et al. does not explicitly disclose the engine being rated at an intake air flow of at least 3 cfm, one of ordinary skill in the art would have expected the engines to be rated at an intake air flow of at least 3 cfm because the engines are disclosed as being for use in motorized vehicles in col. 2, lines 13-27.

Kahlbaugh et al. '399 does not disclose the polymer composition being selected from an addition polymer and about 2 to 25 wt % of an additive, the additive comprising



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a resinous material having a molecular weight of about 500 to 3000 and an aromatic character, the additive being miscible in the polymer, a condensation polymer and about 2 to 25 wt % of an additive, the additive comprising a resinous material having a molecular weight of about 500 to 3000, and an aromatic character wherein the additive is miscible in the condensation polymer, and mixtures thereof.

Gallucci '474 discloses forming fibers from a polymer comprising the condensation polymer nylon and about 2 to 25 weight percent of an additive, the additive comprising a resinous material having a molecular weight of about 400 to 30000 and an aromatic character wherein the additive is miscible in the condensation polymer in col. 1, line 18 to col. 5, line 19.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the incorporate the additive of Gallucci '474 into the nylon fibers of Kahlbaugh et al. '399 to improve the dimensionally stability of the fibers and to reduce the water absorption by the fibers, as suggested by Gallucci '474 in col. 1, line 29 to col. 2, line 41.

Since the prior art range is seen as overlapping the claimed range of the molecular weight being about 500 to 3000, a prima facie case of obviousness exists which must be overcome through a showing of unobvious or unexpected results.

With regard to claims 55, 62, 70, 71, 83, 90, 99, and 100, Kahlbaugh et al. discloses the polymer including a copolymer of nylon and the addition polymers



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polyvinyl chloride, polyvinylidene chloride, and polyvinylidene fluoride in col. 16, lines 48-64.

With regard to claims 64, 65, 92, and 93, Gallucci '474 teaches the additive comprising an oligomer comprising tertiary butyl phenol and having the claimed structure in col. 1, line 49 to col. 5, line 10. Gallucci '474 is seen as disclosing the claimed structure when R is a tertiary butyl group, R' is a direct carbon to carbon bond, and s equals 1.

With regard to claims 66, 67, 94, and 95, Gallucci '474 teaches the additive comprising an oligomer comprising bis-phenol A and having the claimed structure in col. 1, line 49 to col. 5, line 10 and col. 7, lines 28-35. Gallucci '474 is seen as disclosing the claimed structure when R is a alkyl hydroxy aryl group, R' is a direct carbon to carbon bond, and s equals 1.

With regard to claims 68, 69, 96, and 97, Gallucci '474 teaches the additive comprising an oligomer comprising dihydroxy biphenyl and having the claimed structure in col. 1, line 49 to col. 5, line 10. Gallucci '474 is seen as disclosing the claimed structure when R is a hydroxy aryl group, R' is a direct carbon to carbon bond, and s equals 1.



25. Claims 54, 82, and 98 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kahlbaugh et al. '399 and Gallucci '474 as applied to claims 53 and 81 above, and further in view of Barris et al. and Suhonen et al.

Kahlbaugh et al. '399 and Gallucci '474 do not disclose the polymer being a component of a solution, the solution comprising a major proportion of an aqueous alcoholic solvent and about 3 to 30 weight percent of the polymeric composition based on the solution and the fiber retaining a trace amount of solvent.

Barris et al. discloses forming a fine fibers from polyvinylidene chloride wherein the polymer is a component of a solution, the solution comprising a major proportion of methyl ethyl ketone solvent and 7 weight percent of the polymeric composition based on the solution and the fiber retaining a trace amount of solvent in col. 7, line 30 to col. 8, line 30.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the polymeric solution of Barris et al. into the system of Kahlbaugh et al. '399 and Gallucci '474 to allow the fine fibers to be formed by electrostatic spinning, as suggested by Barris in col. 6, lines 8-64.

Barris et al. does not disclose the solvent being an aqueous alcoholic solvent.

Suhonen et al. discloses using an aqueous alcoholic solvent to dissolve nylon in col. 3, lines 23-30.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the aqueous alcoholic solvent of Suhonen et al. into



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the method of Kahlbaugh et al. '399, Gallucci '474, and Barris to allow the fine fibers to be formed of nylon.

26. Claims 56 and 84 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kahlbaugh et al. '399 and Gallucci '474 as applied to claims 53 and 81 above, and further in view of Baumann et al.

Kahlbaugh et al. '399 and Gallucci '474 do not explicitly disclose the nylon polymer comprising a homopolymer having repeating units derived from a cyclic lactam.

Baumann et al. teaches forming fine fibers from a nylon polymer, wherein the polymer comprising a homopolymer (nylon 6) having repeating units derived from a cyclic lactam in col. 5, lines 45-67.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the nylon 6 of Baumann et al. for the nylons of Kahlbaugh et al. '399 and Gallucci '474 in that such are alternate nylons in the art for forming fine fibers, mere substitution of one known fine fiber forming nylon for another in the art being within the scope of one having ordinary skill in the art.

27. Claims 57 and 85 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kahlbaugh et al. '399 and Gallucci '474 as applied to claims 53 and 81 above, and further in view of Okamoto et al. '352.

Kahlbaugh et al. '399 discloses the polymer being nylon, aromatic nylon, or a copolymer of nylon and aromatic nylon in col. 16, lines 48-64.



Kahlbaugh et al. '399 and Gallucci '474 do not explicitly disclose the nylon polymer being a copolymer combined with a second nylon polymer, the second nylon polymer differing in molecular weight or monomer composition, the second nylon polymer comprising an alkoxy alkyl modified polyamide, or the second nylon polymer comprising a nylon copolymer.

Okamoto et al. '352 discloses forming fibers from copolymers of nylon 6, nylon 7, nylon 8, nylon 9, nylon 11, and nylon 12 in col. 3, lines 58-67. Therefore, Okamoto et al. is seen as teaching forming fibers from a copolymer of nylon 6 and nylon 7, wherein the copolymer is combined with a second nylon copolymer comprising an alkoxy alkyl modified polyamide (nylon 8) and nylon 9.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the nylon copolymers of Okamoto et al. '352 for the nylons of Kahlbaugh et al. '399 and Gallucci '474 in that such are alternate nylons in the art for forming fibers, mere substitution of one known fiber forming nylon for another in the art being within the scope of one having ordinary skill in the art.

28. Claims 58 and 86 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kahlbaugh et al. '399 and Gallucci '474 as applied to claims 53 and 81 above, and further in view of Emig et al.

Kahlbaugh et al. '399 and Gallucci '474 do not disclose the fine fiber comprising polyvinyl alcohol or a copolymer of polyamide and polyvinyl alcohol.



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Emig et al. discloses a similar filter media having a layer of fine fiber supported on a substrate wherein the fine fiber comprises polyvinyl alcohol or a copolymer comprising polyamide and polyvinyl alcohol in col. 2, lines 26-53.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the polyvinyl alcohol or copolymer of vinyl alcohol fine fibers of Emig et al. into the system of Kahlbaugh et al. '399 and Gallucci '474 '399 in that such is merely an alternate material in the art for forming a layer of fine fibers, mere substitution of one known fine fiber forming material for another in the art without a showing of unobvious or unexpected results being within the scope of one having ordinary skill in the art.

29. Claims 59, 72, 87, and 101 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kahlbaugh et al. '399, Gallucci '474, and Emig et al. as applied to claims 58 and 86 above, and further in view of European Patent Application EP 0 351 046.

With regard to claims 59 and 87, Kahlbaugh et al. '399, Gallucci '474, and Emig et al. do not disclose the polyvinyl alcohol being crosslinked with about 1 to 40 weight percent of a crosslinking agent.

EP 0 351 046 discloses crosslinking polyvinyl alcohol with 20 weight percent of a polyacrylic acid in page 2, line 42 to page 3, line 7 and page 6, lines 26-51.



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It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the crosslinking of EP 0 351 046 into the fine fiber of Kahlbaugh et al. '399, Gallucci '474, and Emig et al. to provide a polyvinyl alcohol fine fiber having improved hot water resistance, as suggested by EP 0 351 046 in page 2, line 10 to page 3, line 5.

With regard to claims 72 and 101, EP 0 351 046 teaches using polyacrylic acid having any desired molecular weight in page 2, line 54.

Since the prior art range is seen as overlapping the claimed range of a molecular weight between about 1000 and 3000, a prima facie case of obviousness exists which must be overcome through a showing of unexpected or unobvious results.

Furthermore, EP 0 351 046 explicitly teaches the polyacrylic acid having a degree of polymerization of 200 in page 2, lines 54-55. Since acrylic acid has the formula  $\text{CH}_2\text{CHCOOH}$ , the molecular weight of the acrylic acid monomer can be calculated to be 72 and the molecular weight of a polyacrylic acid having a degree of polymerization of 200 can be calculated to be  $72 \times 200 = 14,400$ . It would have been obvious to one of ordinary skill in the art at the time the invention was made to use a polyacrylic acid having a molecular weight of about 3000 since a polyacrylic acid having a molecular weight of about 3000 would be expected to exhibit properties similar to a polyacrylic acid having a molecular weight of 14,400.



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30. Claims 60, 61, 88, and 89 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kahlbaugh et al. '399, Gallucci '474, and Baumann et al. as applied to claims 56 and 84 above, and further in view of Okamoto et al. '352.

With regard to claims 60 and 88, Kahlbaugh et al. '399, Gallucci '474, and Baumann et al. do not disclose the nylon polymer being combined with a second nylon polymer, the second nylon polymer comprising an alkoxy alkyl modified polyamide.

Okamoto et al. '352 discloses forming fibers from copolymers of nylon 6, nylon 7, nylon 8, nylon 9, nylon 11, and nylon 12 in col. 3, lines 58-67. Therefore, Okamoto et al. is seen as teaching forming fibers from a copolymer of nylon 6 and a second nylon polymer comprising an alkoxy alkyl modified polyamide (nylon 8).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the nylon copolymers of Okamoto et al. '352 for the nylons of Kahlbaugh et al. '399, Gallucci '474, and Baumann et al. in that such are alternate nylons in the art for forming fibers, mere substitution of one known fiber forming nylon for another in the art being within the scope of one having ordinary skill in the art.

With regard to claims 61 and 89, Okamoto et al. '352 teaches the nylons being combined to form a copolymer in col. 3, lines 58-67.



Kahlbaugh et al. '399, Gallucci '474, Baumann et al., and Okamoto et al. '352 do not explicitly disclose the polymers being treated to from a single polymeric composition as measured by a differential scanning calorimeter showing a single phase material.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to ensure that the different polymers were sufficiently well mixed to form a single phase continuous copolymer material to ensure that the formed fibers exhibited the desired properties across the entire length and cross-section of the fibers.

31. Claims 63 and 91 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kahlbaugh et al. '399 and Gallucci '474 as applied to claims 62 and 90 above, and further in view of Fujii et al.

Kahlbaugh et al. '399 and Gallucci '474 do not disclose the polyvinyl chloride being crosslinked.

Fujii et al. discloses crosslinking polyvinyl chloride in col. 2, lines 3-6.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the crosslinking of Fujii et al. into the polyvinyl chloride polymers of Kahlbaugh et al. '399 and Gallucci '474 to improve the heat resistance of the polyvinyl chloride, as suggested by Fujii et al. in col. 2, lines 3-6.

32. Claims 73 and 102 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kahlbaugh et al. '399, Gallucci '474, Emig et al., and European Patent Application EP 0 351 046 as applied to claims 59 and 87 above, and further in view of Elmasry



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EP 0 351 046 discloses crosslinking polyvinyl alcohol with 20 weight percent of a crosslinking agent in page 2, line 42 to page 3, line 7 and page 6, lines 26-51.

Kahlbaugh et al. '399, Gallucci '474, Emig et al., and EP 0 351 046 do not disclose the polyvinylalcohol being crosslinked using a melamine-formaldehyde resin having a molecular weight of about 1000 to 3000.

Elmasry teaches using melamine-formaldehyde to crosslink polyvinylalcohol in col. 1, lines 36-39.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the melamine-formaldehyde crosslinking agent of Elmasry into the polyvinylalcohol of Kahlbaugh et al. '399, Gallucci '474, Emig et al., and EP 0 351 046 in that such is an alternate crosslinking agent in the art for crosslinking polyvinylalcohol, mere substitution of one known crosslinking agent for another in the art without a showing of unobvious or unexpected results being within the scope of one having ordinary skill in the art.

EP 0 351 046 teaches the crosslinking agent having any desired molecular weight in page 2, line 54.

Since the prior art range is seen as overlapping the claimed range of a molecular weight between about 1000 and 3000, a prima facie case of obviousness exists which must be overcome through a showing of unexpected or unobvious results.



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33. Claims 74 and 103 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kahlbaugh et al. '399 and Gallucci '474 as applied to claims 53 and 81 above, and further in view of Applicants' admitted prior art.

Kahlbaugh et al. '399 discloses the system including a engine for a vehicle in col. 2, lines 13-27.

Kahlbaugh et al. '399 does not disclose the engine being rated at an engine intake air flow of at least 100 cfm or at least 500 cfm or the primary filter element having a size and construction providing for an initial restriction of no greater than 3 inches of water when evaluated at air flow rates up to 600 cfm.

Applicants' admitted prior art teaches that it is customary for some engines for vehicles to be rated at an engine intake air flow of 800 cfm in page 25, lines 7-26 of the specification.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the engines of Applicants' admitted prior art to allow the system to be on large vehicles having high horsepower requirements.

Kahlbaugh et al. further teaches adjusting the permeability of the substrate and the fine fiber layer depending on the filtration efficiency desired.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to adjust the permeability of the substrate and the fine fiber layer and the size of the filter element to produce a filter element having the desired initial pressure drop and filtration efficiency.



34. Claims 75, 76, 78, 104, 105, and 107 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kahlbaugh et al. '399, Gallucci '474, and Applicants' admitted prior art as applied to claims 74 and 103 above, and further in view of Engel '992.

With regard to claims 75 and 104, Kahlbaugh et al. '399 discloses the pleated construction having a tubular shape and defining an open interior, said air cleaner housing including an airflow tube (102), said primary filter element being operably mounted on said airflow tube, said primary filter element further including a first, open end cap (130) and a second, opposite end cap (131), said media pack being bonded to said first end cap at said first end of said media pack, said media pack being bonded to said second end cap at said second end of said media pack, an inner support liner (112) extending between said first end cap and said second end cap, said first end cap including a radially directed sealing portion (140), said radially directed sealing portion being inwardly directed toward said open interior, said radially directed sealing portion comprising a compressible material compressed between and against said inner support liner and said airflow tube to form a first radial seal between said primary filter element and said air cleaner housing in Fig. 10 and col. 26, lines 22-58.

Kahlbaugh et al. '399 does not disclose the compressible material being polyurethane foam.

Engel '992 discloses a similar filter element having a radial seal portion (40) formed of polyurethane foam in Fig. 4, col. 3, lines 7-12 and col. 5, lines 30-60.



It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the polyurethane foam material of Engel '992 into the filter element of Kahlbaugh et al. '399, Gallucci '474, and Applicants' admitted prior art to provide a reliable seal to prevent unfiltered air from bypassing the filter element.

With regard to claims 76 and 105, Kahlbaugh et al. '399 discloses the primary filter element further including an outer support liner (111) extending between first (130) and second (131) end caps in Fig. 10 and col. 26, lines 22-58.

Kahlbaugh et al. '399 does not disclose said second end cap defining a center aperture, and said second end cap includes an inwardly radially directed sealing portion, said inwardly radially directed sealing portion comprising a polyurethane foam material compressed between and against said outer support liner and said air cleaner to form a second radial seal between said primary filter element and said air cleaner housing.

Engel '992 discloses a similar filter element having second end cap (24) defining a center aperture (96), and said second end cap including an inwardly radially directed sealing portion (75), said inwardly radially directed sealing portion comprising a polyurethane foam material compressed between and against said outer support liner and said air cleaner to form a second radial seal between said primary filter element and said air cleaner housing in Figs. 1-4 and col. 3, line 7 to col. 5, line 60.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the second end cap of Engel '992 into the filter



element of Kahlbaugh et al. '399, Gallucci '474, and Applicants' admitted prior art to provide a second reliable seal between the filter element and the housing to further prevent unfiltered air from bypassing the filter element and to provide a drainage aperture for removing water from the filter element, as suggested by Engel '992 in col. 7, lines 41-64.

With regard to claims 78 and 107, Kahlbaugh et al. '399 discloses the pleated construction having a tubular shape and defines an open interior, said primary filter element further includes a first, open end cap (130) and a second, opposite closed end cap (131), said media pack being bonded to said first end cap at said first end of said media pack, said media pack being bonded to said second end cap at said second end of said media pack and said first end cap including an axially directed sealing portion in Fig. 10 and col. 26, lines 22-58.

Kahlbaugh et al. '399 does not disclose the air cleaner housing including a yoke arrangement to secure said housing to said primary filter element or said axially directed sealing portion being pressed against said air cleaner housing by said yoke arrangement to form an axial seal between said primary filter element and said air cleaner housing.

Engel '992 teaches a similar air cleaner housing including a yoke arrangement to secure said housing to said primary filter element and said axially directed sealing portion being pressed against said air cleaner housing by said yoke arrangement to



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form an axial seal between said primary filter element and said air cleaner housing in col. 8, line 58 to col. 9, line 9.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the yoke arrangement of Engel '992 into the system of Kahlbaugh et al. '399, Gallucci '474, and Applicants' admitted prior art to provide a reliable system for forming an axial seal between the filter element and the housing.

35. Claims 77 and 106 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kahlbaugh et al. '399, Gallucci '474, and Applicants' admitted prior art as applied to claims 74 and 103 above, and further in view of Brown et al. and Engel '992.

Kahlbaugh et al. '399 does not disclose the system further including a safety element operably installed in said air cleaner housing, said safety element including a pleated construction of a media composite, said safety element pleated construction including a plurality of pleats, said safety element pleated construction having a tubular shape and defining an open interior, a safety element first end cap and a safety element second end cap, said safety element pleated construction being bonded to and extending between said safety element first and second end caps, said safety element first end cap being ring-shaped defining an opening, said safety element second end cap being closed, and said safety element first end cap including an outwardly radially directed sealing portion, said outwardly radially directed sealing portion comprising a polyurethane material compressible to form a radial seal between said safety element and said air cleaner housing airflow tube.



Brown et al. discloses a similar system including a safety element (31) operably installed in said air cleaner housing, said safety element including a pleated construction of a media composite, said safety element pleated construction including a plurality of pleats, said safety element pleated construction having a tubular shape and defining an open interior, a safety element first end cap (50) and a safety element second end cap (80), said safety element pleated construction being bonded to and extending between said safety element first and second end caps, said safety element first end cap being ring-shaped defining an opening, said safety element second end cap being closed, and said safety element first end cap including an outwardly radially directed sealing portion (41), said outwardly radially directed sealing portion comprising a nitrile rubber material compressible to form a radial seal between said safety element and said air cleaner housing airflow tube (26) in Figs. 1 and 3 and col. 3, line 14 to col. 6, line 48.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the safety element of Brown et al. into the system of Kahlbaugh et al. '399, Gallucci '474, and Applicants' admitted prior art to provide a second filter element for filtering the intake air in the event that the primary filter element becomes damaged.

Brown et al. does not disclose the compressible material being polyurethane foam.

Engel '992 discloses a similar filter element having a radial seal portion (40) formed of polyurethane foam in Fig. 4, col. 3, lines 7-12 and col. 5, lines 30-60.



It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the polyurethane foam material of Engel '992 into the safety filter element of Brown et al., Kahlbaugh et al. '399, Gallucci '474, and Applicants' admitted prior art to provide a reliable seal to prevent unfiltered air from bypassing the safety filter element.

36. Claims 79 and 108 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kahlbaugh et al. '399, Gallucci '474, and Applicants' admitted prior art as applied to claims 74 and 103 above, and further in view of Boeckermann et al.

Kahlbaugh et al. '399 discloses the primary filter element including first (130) and second (131) opposite end caps bonded to said pleated construction in Fig. 10 and col. 26, lines 22-58.

Kahlbaugh et al. '399 does not disclose the first end cap defining a plurality of air inlet apertures and an outlet tube, said outlet tube being secured to an air intake conduit of said engine, said pleated construction being tubular in shape defining an open interior, said second end cap being closed, and, said air cleaner housing being non-removably secured to said first and second end caps.

Boeckermann et al. discloses a similar system having a primary filter element including first (20) and second (19) opposite end caps bonded to said pleated construction, the first end cap defining a plurality of air inlet apertures (23) and an outlet tube (10), said outlet tube being secured to an air intake conduit of said engine, said pleated construction being tubular in shape defining an open interior, said second end



cap being closed, and said air cleaner housing being non-removably secured to said first and second end caps in Figs. 1-3 and col. 1, line 5 to col. 3, line 33.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the filter housing of Boeckermann et al. into the filter system of Kahlbaugh et al. '399, Gallucci '474, and Applicants' admitted prior art to provide a disposable system that does not require the user to replace the filter element.

37. Claims 80 and 109 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kahlbaugh et al. '399, Gallucci '474, and Applicants' admitted prior art as applied to claims 74 and 103 above, and further in view of Lanier, Jr. et al.

Kahlbaugh et al. does not disclose the primary filter element comprising a panel filter construction having an outer perimeter, at least 40 pleats, each of the pleats having a pleat depth of at least 2 inches, an area within said outer perimeter of at least 35 square inches, and an outer gasket member along said outer perimeter comprising a polymeric material.

Lanier, Jr. et al. discloses a similar system including a primary filter element comprising a panel filter construction (10) having an outer perimeter, 62 pleats, and an outer gasket member (54) along said outer perimeter comprising a polymeric material in Fig. 1 and col. 2, line 49 to col. 4, line 26.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the filter media of Kahlbaugh et al. '399 and Gallucci '474 into the primary filter element of Lanier, Jr. et al. to provide an improved filter media



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having a longer lifetime at a given efficiency and flow rate, as suggested by Kahlbaugh et al. '399 in col. 1, line 3 to col. 3, line 35 and col. 9, line 15 to col. 11, line 28.

Lanier, Jr. et al. does not disclose each of the pleats having a pleat depth of at least 2 inches and an area within said outer perimeter being at least 35 square inches.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to adjust the pleat depth and the size of the primary filter element of Lanier, Jr. et al. to provide a filter element having a desired surface area of filtration media for a particular application.

38. Claim 110 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kahlbaugh et al. '399 and Gallucci '474 as applied to claim 81 above, and further in view of Engel '992.

Kahlbaugh et al. '399 discloses the pleated construction having a tubular shape and defines an open interior, said primary filter element further includes a first, open end cap (130) and a second, opposite closed end cap (131), said media pack being bonded to said first end cap at said first end of said media pack, said media pack being bonded to said second end cap at said second end of said media pack and said first end cap including an axially directed sealing portion in Fig. 10 and col. 26, lines 22-58.

Kahlbaugh et al. '399 does not disclose the air cleaner housing including a yoke arrangement to secure said housing to said primary filter element or said axially directed sealing portion being pressed against said air cleaner housing by said yoke



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arrangement to form an axial seal between said primary filter element and said air cleaner housing.

Engel '992 teaches a similar air cleaner housing including a yoke arrangement to secure said housing to said primary filter element and said axially directed sealing portion being pressed against said air cleaner housing by said yoke arrangement to form an axial seal between said primary filter element and said air cleaner housing in col. 8, line 58 to col. 9, line 9.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the yoke arrangement of Engel '992 into the system of Kahlbaugh et al. '399 and Gallucci '474 to provide a reliable system for forming an axial seal between the filter element and the housing.

39. Claims 111, 112, 119, 121-127, 144, and 145 are rejected under 35 U.S.C. 103(a) as being unpatentable over Copley '751 in view of Kahlbaugh et al. '399 and Gallucci '474.

With regard to claim 111, Copley '751 discloses a system having an air cleaner constructed and arranged to filter gas turbine intake air, the cleaner comprising a media pack having a first filter panel (44) and a second filter panel (45), each of said filter panels including a pleated construction of a media composite, said pleated construction including a plurality of pleats in Figs. 1-4.



Copley '751 does not disclose the system including a vehicles powered by a gas turbine engine or the media composite including a substrate (150) at least partially covered by a layer (151), said layer comprising a fine fiber having a diameter of 0.1 microns such that after test exposure for a test period of 16 hours to test conditions of 140 °F air and a relative humidity of 100% retains greater than 30% of the fiber unchanged for filtration purposes, or the polymer composition being selected from an addition polymer and about 2 to 25 wt % of an additive, the additive comprising a resinous material having a molecular weight of about 500 to 3000 and an aromatic character, the additive being miscible in the polymer, a condensation polymer and about 2 to 25 wt % of an additive, the additive comprising a resinous material having a molecular weight of about 500 to 3000, and an aromatic character wherein the additive is miscible in the condensation polymer, and mixtures thereof

Kahlbaugh et al. '399 discloses a system including a vehicles powered by a gas turbine engine and having an air cleaner constructed and arranged to filter gas turbine intake air, including a media composite including a substrate (150) at least partially covered by a layer (151), said layer comprising a fine fiber having a diameter of 0.1 microns such that after test exposure for a test period of 16 hours to test conditions of 140 °F air and a relative humidity of 100% retains greater than 30% of the fiber unchanged for filtration purposes, said fiber comprising polymeric compositions including condensation polymers including nylon and addition polymers including polyvinyl chloride in Figs. 8-11, col. 2, lines 13-27, col. 14, line 35 to col. 17, line 28, and col. 25, line 5 to col. 27, line 32.



Since the prior art is seen as disclosing a specific example lying within the claimed range of the fine fiber comprising a diameter of about 0.01 to 0.5 microns, this limitation is anticipated.

With regard to the thermal and humidity resistance of the fine fibers, both Applicants and Kahlbaugh et al '399 disclose forming the fine fiber layer of the same materials. Specifically, Applicants teach forming the fine fiber layer from polyolefin, polyvinyl chloride (PVC), cellulose ester, polyamides, polystyrene, polysulfones, polyvinylidene fluoride, polyvinylidene chloride, and nylon in page 13, lines 3-30. Kahlbaugh et al. '399 teaches forming the fine fibers from identical materials in col. 16, lines 53-64. Since Applicants and Kahlbaugh et al '399 both teach the fine fiber layer being formed from the same material, the fine fibers of Kahlbaugh et al. '399 would inherently have the same heat and humidity resistance properties as the fine fibers of the present invention.

Gallucci '474 discloses forming fibers from a polymer comprising the condensation polymer nylon and about 2 to 25 weight percent of an additive, the additive comprising a resinous material having a molecular weight of about 400 to 30000 and an aromatic character wherein the additive is miscible in the condensation polymer in col. 1, line 18 to col. 5, line 19.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the additive of Gallucci '474 into the nylon fibers of Kahlbaugh et al. '399 to improve the dimensionally stability of the fibers



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and to reduce the water absorption by the fibers, as suggested by Gallucci '474 in col. 1, line 29 to col. 2, line 41.

Since the prior art range is seen as overlapping the claimed range of the molecular weight being about 500 to 3000, a prima facie case of obviousness exists which must be overcome through a showing of unobvious or unexpected results.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the media composite of Kahlbaugh et al. '399 and Gallucci '474 into the system of Copley '751 to provide an improved filter media having a longer lifetime at a given efficiency and flow rate, as suggested by Kahlbaugh et al. '399 in col. 1, line 3 to col. 3, line 35 and col. 9, line 15 to col. 11, line 28.

With regard to claims 112 and 119, Kahlbaugh et al. discloses the polymer including a copolymer of nylon and the addition polymers polyvinyl chloride, polyvinylidene chloride, and polyvinylidene fluoride in col. 16, lines 48-64.

With regard to claims 121 and 122, Gallucci '474 teaches the additive comprising an oligomer comprising tertiary butyl phenol and having the claimed structure in col. 1, line 49 to col. 5, line 10. Gallucci '474 is seen as disclosing the claimed structure when R is a tertiary butyl group, R' is a direct carbon to carbon bond, and s equals 1.

With regard to claims 123 and 124, Gallucci '474 teaches the additive comprising an oligomer comprising bis-phenol A and having the claimed structure in col. 1, line 49



to col. 5, line 10 and col. 7, lines 28-35. Gallucci '474 is seen as disclosing the claimed structure when R is a alkyl hydroxy aryl group, R' is a direct carbon to carbon bond, and s equals 1.

With regard to claims 125 and 126, Gallucci '474 teaches the additive comprising an oligomer comprising dihydroxy biphenyl and having the claimed structure in col. 1, line 49 to col. 5, line 10. Gallucci '474 is seen as disclosing the claimed structure when R is a hydroxy aryl group, R' is a direct carbon to carbon bond, and s equals 1.

With regard to claim 127, Copley discloses the media pack including a first end and a second end, said first and second filter panels being oriented in a V-configuration and diverge from one another along a direction of extension from said first end to said second end to form a clean air space in said media pack between said first and second filter panels in Figs. 1-4.

With regard to claims 144 and 145, Kahlbaugh et al. '399 discloses the vehicle being a military tank or a bus on col. 2, lines 13-27.

40. Claim 113 is rejected under 35 U.S.C. 103(a) as being unpatentable over Copley '751, Kahlbaugh et al. '399 and Gallucci '474 as applied to claim 111 above, and further in view of Baumann et al.



Copley '751, Kahlbaugh et al. '399 and Gallucci '474 do not explicitly disclose the nylon polymer comprising a homopolymer having repeating units derived from a cyclic lactam.

Baumann et al. teaches forming fine fibers from a nylon polymer, wherein the polymer comprising a homopolymer (nylon 6) having repeating units derived from a cyclic lactam in col. 5, lines 45-67.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the nylon 6 of Baumann et al. for the nylons of Copley '751, Kahlbaugh et al. '399 and Gallucci '474 in that such are alternate nylons in the art for forming fine fibers, mere substitution of one known fine fiber forming nylon for another in the art being within the scope of one having ordinary skill in the art.

41. Claim 114 rejected under 35 U.S.C. 103(a) as being unpatentable over Copley '751, Kahlbaugh et al. '399 and Gallucci '474 as applied to claim 111 above, and further in view of Okamoto et al. '352.

Kahlbaugh et al. '399 discloses the polymer being nylon, aromatic nylon, or a copolymer of nylon and aromatic nylon in col. 16, lines 48-64.

Copley '751, Kahlbaugh et al. '399 and Gallucci '474 do not explicitly disclose the nylon polymer being a copolymer combined with a second nylon polymer or second nylon polymer differing in molecular weight or monomer composition.

Okamoto et al. '352 discloses forming fibers from copolymers of nylon 6, nylon 7, nylon 8, nylon 9, nylon 11, and nylon 12 in col. 3, lines 58-67. Therefore, Okamoto et al.



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is seen as teaching forming fibers from a copolymer of nylon 6 and nylon 7, wherein the copolymer is combined with a second nylon copolymer comprising an alkoxy alkyl modified polyamide (nylon 8) and nylon 9.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the nylon copolymers of Okamoto et al. '352 for the nylons of Copley '751, Kahlbaugh et al. '399 and Gallucci '474 in that such are alternate nylons in the art for forming fibers, mere substitution of one known fiber forming nylon for another in the art being within the scope of one having ordinary skill in the art.

42. Claim 115 is rejected under 35 U.S.C. 103(a) as being unpatentable over Copley '751, Kahlbaugh et al. '399 and Gallucci '474 as applied to claim 111 above, and further in view of Emig et al.

Copley '751, Kahlbaugh et al. '399 and Gallucci '474 do not disclose the fine fiber comprising polyvinyl alcohol or a copolymer of polyamide and polyvinyl alcohol.

Emig et al. discloses a similar filter media having a layer of fine fiber supported on a substrate wherein the fine fiber comprises polyvinyl alcohol or a copolymer comprising polyamide and polyvinyl alcohol in col. 2, lines 26-53.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the polyvinyl alcohol or copolymer of vinyl alcohol fine fibers of Emig et al. into the system of Copley '751, Kahlbaugh et al. '399 and Gallucci '474 in that such is merely an alternate material in the art for forming a layer of fine fibers, mere substitution of one known fine fiber forming material for another in the



art without a showing of unobvious or unexpected results being within the scope of one having ordinary skill in the art.

43. Claim 116 is rejected under 35 U.S.C. 103(a) as being unpatentable over Copley '751, Kahlbaugh et al. '399, Gallucci '474, and Emig et al. as applied to claim 115 above, and further in view of European Patent Application EP 0 351 046.

Copley '751, Kahlbaugh et al. '399, Gallucci '474, and Emig et al. do not disclose the polyvinyl alcohol being crosslinked with about 1 to 40 weight percent of a crosslinking agent.

EP 0 351 046 discloses crosslinking polyvinyl alcohol with 20 weight percent of a polyacrylic acid in page 2, line 42 to page 3, line 7 and page 6, lines 26-51.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the crosslinking of EP 0 351 046 into the fine fiber of Copley '751, Kahlbaugh et al. '399, Gallucci '474, and Emig et al. to provide a polyvinyl alcohol fine fiber having improved hot water resistance, as suggested by EP 0 351 046 in page 2, line 10 to page 3, line 5.

44. Claims 117 and 118 are rejected under 35 U.S.C. 103(a) as being unpatentable over Copley '751, Kahlbaugh et al. '399, Gallucci '474, and Baumann et al. as applied to claim 113 above, and further in view of Okamoto et al. '352.



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With regard to claim 117, Copley '751, Kahlbaugh et al. '399, Gallucci '474, and Baumann et al. do not disclose the nylon polymer being combined with a second nylon polymer, the second nylon polymer comprising an alkoxy alkyl modified polyamide.

Okamoto et al. '352 discloses forming fibers from copolymers of nylon 6, nylon 7, nylon 8, nylon 9, nylon 11, and nylon 12 in col. 3, lines 58-67. Therefore, Okamoto et al. is seen as teaching forming fibers from a copolymer of nylon 6 and a second nylon polymer comprising an alkoxy alkyl modified polyamide (nylon 8).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the nylon copolymers of Okamoto et al. '352 for the nylons of Copley '751, Kahlbaugh et al. '399, Gallucci '474, and Baumann et al. in that such are alternate nylons in the art for forming fibers, mere substitution of one known fiber forming nylon for another in the art being within the scope of one having ordinary skill in the art.

With regard to claim 118, Okamoto et al. '352 teaches the nylons being combined to form a copolymer in col. 3, lines 58-67.

Copley '751, Kahlbaugh et al. '399, Gallucci '474, Baumann et al., and Okamoto et al. '352 do not explicitly disclose the polymers being treated to from a single polymeric composition as measured by a differential scanning calorimeter showing a single phase material.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to ensure that the different polymers were sufficiently well mixed to



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form a single phase continuous copolymer material to ensure that the formed fibers exhibited the desired properties across the entire length and cross-section of the fibers.

45. Claim 120 is rejected under 35 U.S.C. 103(a) as being unpatentable over Copley '751, Kahlbaugh et al. '399 and Gallucci '474 as applied to claim 119 above, and further in view of Fujii et al.

Copley '751, Kahlbaugh et al. '399 and Gallucci '474 do not disclose the polyvinyl chloride being crosslinked.

Fujii et al. discloses crosslinking polyvinyl chloride in col. 2, lines 3-6.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the crosslinking of Fujii et al. into the polyvinyl chloride polymers of Copley '751, Kahlbaugh et al. '399 and Gallucci '474 to improve the heat resistance of the polyvinyl chloride, as suggested by Fujii et al. in col. 2, lines 3-6.

46. Claims 128, 129, 146, and 147 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kahlbaugh et al. '399 in view of Gallucci '474.

With regard to claims 128 and 146, Kahlbaugh et al. '399 discloses a method for filtering vehicle cabin ventilation air, the vehicle having a temperature of at least 140 OF during any period of operation comprising directing the air through a media composite, the media composite including a sheet-like substrate (150) at least partially covered by



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a layer (151), said layer comprising a fine fiber having a diameter of 0.1 microns such that after test exposure for a test period of 16 hours to test conditions of 140 °F air and a relative humidity of 100% retains greater than 30% of the fiber unchanged for filtration purposes, said fiber comprising polymeric compositions including condensation polymers including nylon and addition polymers including polyvinyl chloride in Figs. 8-11, col. 2, lines 13-27, col. 14, line 35 to col. 17, line 28, and col. 25, line 5 to col. 27, line 32.

Since the prior art is seen as disclosing a specific example lying within the claimed range of the fine fiber comprising a diameter of about 0.01 to 0.5 microns, this limitation is anticipated.

With regard to the thermal and humidity resistance of the fine fibers, both Applicants and Kahlbaugh et al '399 disclose forming the fine fiber layer of the same materials. Specifically, Applicants teach forming the fine fiber layer from polyolefin, polyvinyl chloride (PVC), cellulose ester, polyamides, polystyrene, polysulfones, polyvinylidene fluoride, polyvinylidene chloride, and nylon in page 13, lines 3-30. Kahlbaugh et al. '399 teaches forming the fine fibers from identical materials in col. 16, lines 53-64. Since Applicants and Kahlbaugh et al '399 both teach the fine fiber layer being formed from the same material, the fine fibers of Kahlbaugh et al. '399 would inherently have the same heat and humidity resistance properties as the fine fibers of the present invention.

While Kahlbaugh et al. does not explicitly disclose the engine being rated at an intake air flow of at least 3 cfm, one of ordinary skill in the art would have expected the



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engines to be rated at an intake air flow of at least 3 cfm because the engines are disclosed as being for use in motorized vehicles in col. 2, lines 13-27.

Kahlbaugh et al. '399 does not disclose the polymer composition being selected from an addition polymer and about 2 to 25 wt % of an additive, the additive comprising a resinous material having a molecular weight of about 500 to 3000 and an aromatic character, the additive being miscible in the polymer, a condensation polymer and about 2 to 25 wt % of an additive, the additive comprising a resinous material having a molecular weight of about 500 to 3000, and an aromatic character wherein the additive is miscible in the condensation polymer, and mixtures thereof.

Gallucci '474 discloses forming fibers from a polymer comprising the condensation polymer nylon and about 2 to 25 weight percent of an additive, the additive comprising a resinous material having a molecular weight of about 400 to 30000 and an aromatic character wherein the additive is miscible in the condensation polymer in col. 1, line 18 to col. 5, line 19.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the incorporate the additive of Gallucci '474 into the nylon fibers of Kahlbaugh et al. '399 to improve the dimensionally stability of the fibers and to reduce the water absorption by the fibers, as suggested by Gallucci '474 in col. 1, line 29 to col. 2, line 41.

Since the prior art range is seen as overlapping the claimed range of the molecular weight being about 500 to 3000, a prima facie case of obviousness exists which must be overcome through a showing of unobvious or unexpected results.



With regard to claims 129 and 147, Kahlbaugh et al. '399 discloses the step of directing the air through a media pack includes directing the air into an air intake conduit of an engine rated at an engine intake air flow of at least 3 cfm, the pleated construction having a tubular shape with a plurality of pleats extending between first (130) and second (132) opposite end caps in Figs. 8-11, col. 2, lines 13-27, col. 14, line 35 to col. 17, line 28, and col. 25, line 5 to col. 27, line 32..

While Kahlbaugh et al. does not explicitly disclose the engine being rated at an intake air flow of at least 3 cfm, one of ordinary skill in the art would have expected the engines to be rated at an intake air flow of at least 3 cfm because the engines are disclosed as being for use in motorized vehicles in col. 2, lines 13-27.

47. Claims 130, 131, 148, and 149 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kahlbaugh et al. '399 and Gallucci '474 as applied to claims 128 and 146 above, and further in view of Copley '751.

With regard to claims 130 and 148, Kahlbaugh et al. '399 discloses the step of directing the air through a media pack including directing the air into an air intake conduit of a fluid compressor in col. 2, lines 13-27.

Kahlbaugh et al. '399 and Gallucci '474 do not disclose the pleated construction being a panel filter with at least 40 pleats each having a pleat depth of at least 2 inches.



Copley '751 discloses a similar method wherein the pleated construction is a panel filter (44) in Figs. 1-4.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the panel filter of Copley '751 into the method of Kahlbaugh et al. '399 and Gallucci '474 to allow the method to be used in systems requiring panel filters.

Copley '751 does not disclose the panel filter having at least 40 pleats each having a pleat depth of at least 2 inches.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to adjust the number of pleats and the pleat depth of Lanier, Jr. et al. to provide a filter element having a desired surface area of filtration media for a particular application.

With regard to claims 131 and 149, Kahlbaugh et al. '399 discloses the step of directing the air through a media pack including directing the air into an air intake conduit of a gas turbine powered tank.

Kahlbaugh et al. 399 does not disclose the pleated construction including first and second pleated filter panels oriented in a V configuration.

Copley '751 discloses the pleated construction including first and second pleated filter panels oriented in a V configuration.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the panel filter of Copley '751 into the method of



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Kahlbaugh et al. '399 and Gallucci '474 to allow the method to be used in systems requiring panel filters.

48. Claims 132 and 139-143 are rejected under 35 U.S.C. 103(a) as being unpatentable over Engel '992 in view of Kahlbaugh et al. '399 and Gallucci '474.

With regard to claim 132, Engel '992 discloses a filter element (21) comprising a media pack (25) comprising a construction of a media composite, said construction including a sheet-like substrate (30) having a plurality of pleats having a length extending from said first end to said second end, said construction having a tubular shape and defining an open interior having a first and a second opposite ends, a first end cap (23) and a second end cap (24), said media pack being secured to said first end cap at said first end of said media pack, said media pack being secured to said second end cap at said second end of said media pack, at least one of said first and second end caps including a radially directed sealing portion (40), said radially directed sealing portion comprising a polyurethane material compressible in a direction toward said media pack in Figs. 1-4 and col. 3, line 7 to col. 5, line 60.

Engel '992 does not disclose said sheet-like substrate at least partially covered by a layer, said layer comprising a polymeric fine fiber comprising a fiber with a diameter of about 0.01 to 0.5 microns such that after test exposure for a test period of 16 hours to test conditions of 140 °F air and a relative humidity of 100% retains greater than 30% of the fiber unchanged for filtration purposes, the fiber comprising a



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condensation polymer and about 2 to 25 weight percent of an additive, the additive comprising a resinous material having a molecular weight of about 500 to 3000, and an aromatic character wherein the additive is miscible in the condensation polymer, said condensation polymer comprising a copolymer other than a copolymer formed from a cyclic lactam and a C<sub>6-10</sub> diamine monomer or a C<sub>6-10</sub> diacid monomer.

Kahlbaugh et al. '399 discloses a similar filter assembly having a filter media comprising a pleated filter media composite including a sheet-like substrate (31) at least partially covered by a layer of fine fiber (32), said fiber comprising a diameter of 0.1 microns, the polymer comprising nylons, aromatic nylons, or copolymers of nylons and aromatic nylons in Figs. 8-11, col. 14, line 35 to col. 17, line 28, col. 18, lines 48-64, and col. 25, line 5 to col. 27, line 32. Since Kahlbaugh et al. '399 teaches using nylons, aromatic nylons, or copolymers of nylons and aromatic nylons, Kahlbaugh et al. '399 is seen as teaching the polymer comprising a condensation polymer other than a copolymer formed from a cyclic lactam and a C<sub>6-10</sub> diamine monomer or a C<sub>6-10</sub> diacid monomer.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the filter media of Kahlbaugh et al. '399 into the air filter assembly of Engel '992 to provide an improved filter media having a longer lifetime at a given efficiency and flow rate, as suggested by Kahlbaugh et al. '399 in col. 1, line 3 to col. 3, line 35 and col. 9, line 15 to col. 11, line 28.



Since the prior art is seen as disclosing a specific example lying within the claimed range of the fine fiber comprising a diameter of about 0.01 to 0.5 microns, this limitation is anticipated.

With regard to the thermal and humidity resistance of the fine fibers, both Applicants and Kahlbaugh et al '399 disclose forming the fine fiber layer of the same materials. Specifically, Applicants teach forming the fine fiber layer from polyolefin, polyvinyl chloride (PVC), cellulose ester, polyamides, polystyrene, polysulfones, polyvinylidene fluoride, polyvinylidene chloride, and nylon in page 13, lines 3-30. Kahlbaugh et al. '399 teaches forming the fine fibers from identical materials in col. 16, lines 53-64. Since Applicants and Kahlbaugh et al '399 both teach the fine fiber layer being formed from the same material, the fine fibers of Kahlbaugh et al. '399 would inherently have the same heat and humidity resistance properties as the fine fibers of the present invention.

Gallucci '474 discloses forming fibers from a polymer comprising nylon and a resinous additive comprising an oligomer having a molecular weight of about 400 to 30000 and an alkyl phenolic character wherein the additive is miscible in the condensation polymer in col. 1, line 18 to col. 5, line 19.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the additive of Gallucci '474 into the nylon fibers of Engel '992 and Kahlbaugh et al. '399 to improve the dimensionally stability of the fibers and to reduce the water absorption by the fibers, as suggested by Gallucci '474 in col. 1, line 29 to col. 2, line 41.



Since the prior art range is seen as overlapping the claimed range of the molecular weight being about 500 to 3000, a prima facie case of obviousness exists which must be overcome through a showing of unobvious or unexpected results.

With regard to claim 139, Engel '992 discloses the sealing portion comprising polyurethane foam having an as molded density of 14-22 lbs/in<sup>3</sup> in col. 3, lines 7-13.

With regard to claim 140, Engel '992 discloses the first end cap (23) being ring shaped and defining an open center and includes an inner radial seal surface (40) facing the open center, the sealing portion comprising said inner radial surface in Fig. 4 and col. 5, lines 30-60.

With regard to claim 141, Engel '992 discloses the filter element further including an inner support liner (26) extending between the first and second end caps, said inner support liner being between said sealing portion and said media pack in Fig. 4 and col. 5, lines 19-23.

With regard to claims 142, Engel '992 discloses the second end cap (24) including an outer radial surface (75), said sealing portion comprising said outer radial surface in Fig. 5 and col. 6, line 60 to col. 7, line 15.



With regard to claim 143, Engel '992 discloses the filter element further including an inner support liner (26) extending between the first and second end caps and an outer support liner (27) extending between the first and second end caps in Fig. 4 and col. 5, lines 19-23.

49. Claim 133 is rejected under 35 U.S.C. 103(a) as being unpatentable over Engel '992, Kahlbaugh et al. '399, and Gallucci '474 as applied to claim 132 above, and further in view of Barris et al. and Suhonen et al.

Engel '992, Kahlbaugh et al. '399, and Gallucci '474 do not disclose the polymer being a component of a solution, the solution comprising a major proportion of an aqueous alcoholic solvent and about 3 to 30 weight percent of the polymeric composition based on the solution and the fiber retaining a trace amount of solvent.

Barris et al. discloses forming a fine fibers from polyvinylidene chloride wherein the polymer is a component of a solution, the solution comprising a major proportion of methyl ethyl ketone solvent and 7 weight percent of the polymeric composition based on the solution and the fiber retaining a trace amount of solvent in col. 7, line 30 to col. 8, line 30.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the polymeric solution of Barris et al. into the system of Engel '992, Kahlbaugh et al. '399, and Gallucci '474 to allow the fine fibers to be formed by electrostatic spinning, as suggested by Barris in col. 6, lines 8-64.

Barris et al. does not disclose the solvent being an aqueous alcoholic solvent.



Suhonen et al. discloses using an aqueous alcoholic solvent to dissolve nylon in col. 3, lines 23-30.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the aqueous alcoholic solvent of Suhonen et al. into the method of Engel '992, Kahlbaugh et al. '399, Gallucci '474, and Barris to allow the fine fibers to be formed of nylon.

50. Claims 134 and 136 are rejected under 35 U.S.C. 103(a) as being unpatentable over Engel '992, Kahlbaugh et al. '399, and Gallucci '474 as applied to claim 132 above, and further in view of Emig et al. and Baumann et al.

Engel '992, Kahlbaugh et al. '399, and Gallucci '474 do not disclose the polymer comprising a polyalkylene terephthalate.

Emig et al. teaches forming microfibers from copolymers of polyamides and polyesters in col. 2, lines 59-65.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the copolymer of polyamide and polyester of Emig et al. for the polymers of Engel '992, Kahlbaugh et al. '399, and Gallucci '474 in that such are alternate polymers in the art for forming fine fibers, mere substitution of one known fine fiber forming polymer for another in the art being within the scope of one having ordinary skill in the art.

Engel '992, Kahlbaugh et al. '399, and Emig et al. do not disclose the polyester being a polyalkylene terephthalate.



Baumann et al. teaches polyethylene terephthalate being a well known polyester used in the formation of fine fibers in col. 5, lines 45-67.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the polyethylene terephthalate of Baumann et al. for the polyesters of Engel '992, Kahlbaugh et al. '399, Gallucci '474, and Emig et al. in that such are alternate polyesters in the art for forming fine fibers, mere substitution of one known fine fiber forming polyester for another in the art being within the scope of one having ordinary skill in the art.

51. Claim 135 is rejected under 35 U.S.C. 103(a) as being unpatentable over Engel '992, Kahlbaugh et al. '399, and Gallucci '474 as applied to claim 132 above, and further in view of Asano et al.

Engel '992, Kahlbaugh et al. '399, and Gallucci '474 do not disclose the polymer comprising polyalkylene naphthalate.

Asano et al. teaches it being well known to form fibers from polyalkylene naphthalate in col. 1, lines 42-45.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the polyalkylene naphthalate of Asano et al. into the fibers of Engel '992, Kahlbaugh et al. '399, and Gallucci '474 to improve the durability of the fiber, as suggested by Asano et al. in col. 1, lines 42-45.



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52. Claims 137 and 138 are rejected under 35 U.S.C. 103(a) as being unpatentable over Engel '992, Kahlbaugh et al. '399, and Gallucci '474 as applied to claim 132 above, and further in view of Okamoto et al. '352.

Kahlbaugh et al. '399 discloses the polymer being nylon, aromatic nylon, or a copolymer of nylon and aromatic nylon in col. 16, lines 48-64.

Engel '992, Kahlbaugh et al. '399, and Gallucci '474 do not explicitly disclose the nylon polymer being a copolymer combined with a second nylon polymer, the second nylon polymer differing in molecular weight or monomer composition, the second nylon polymer comprising an alkoxy alkyl modified polyamide, or the second nylon polymer comprising a nylon copolymer.

Okamoto et al. '352 discloses forming fibers from copolymers of nylon 6, nylon 7, nylon 8, nylon 9, nylon 11, and nylon 12 in col. 3, lines 58-67. Therefore, Okamoto et al. is seen as teaching forming fibers from a copolymer of nylon 6 and nylon 7, wherein the copolymer is combined with a second nylon copolymer comprising an alkoxy alkyl modified polyamide (nylon 8) and nylon 9.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the nylon copolymers of Okamoto et al. '352 for the nylons of Engel '992, Kahlbaugh et al. '399, and Gallucci '474 in that such are alternate nylons in the art for forming fibers, mere substitution of one known fiber forming nylon for another in the art being within the scope of one having ordinary skill in the art.

### ***Conclusion***



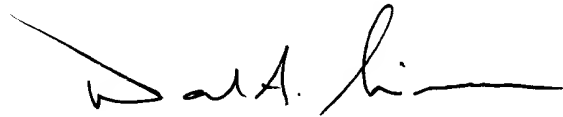
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53. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jason M. Greene whose telephone number is (703) 308-6240. The examiner can normally be reached on Tuesday - Friday (7:00 AM to 5:30 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Simmons can be reached on (703) 308-1972. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9310 for regular communications and (703) 872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

Jason M. Greene  
Examiner  
Art Unit 1724



jmg  
September 20, 2002